

DESCRIPTION: 9.7" XGA LCD Module

CUSTOMER: _____

Product No: M097SNX1-ZH

Released Date: 2019.

Revision: 3.0

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Revision History

| Version | Date | Modified Page | Description |
|----------------|-------------|----------------------|--------------------|
| 1.0 | 2013.09.04 | - | initial release |
| 2.0 | 2014.02.11 | | update |
| 3.0 | 2019.8.12 | | update |
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1 General Descriptions

1.1 Introduction

The M097SNX1 ZH is a Color Active Matrix Thin Film Transistor (TFT) Liquid Crystal Display (LCD) panel, which used amorphous Silicon TFT as a switching device. It is composed of a TFT LCD panel, a timing controller, column driver, and row driver circuit. This TFT LCD has a 9.7-inch (diagonally measured) active display area with XGA resolution (1024 horizontal by 768 vertical pixel array).

1.2 Features

- 9.7" TFT LCD Panel
- LED Backlight System
- Supports XGA (1024X768 pixels) Resolution
- Compatible with RoHS Standard

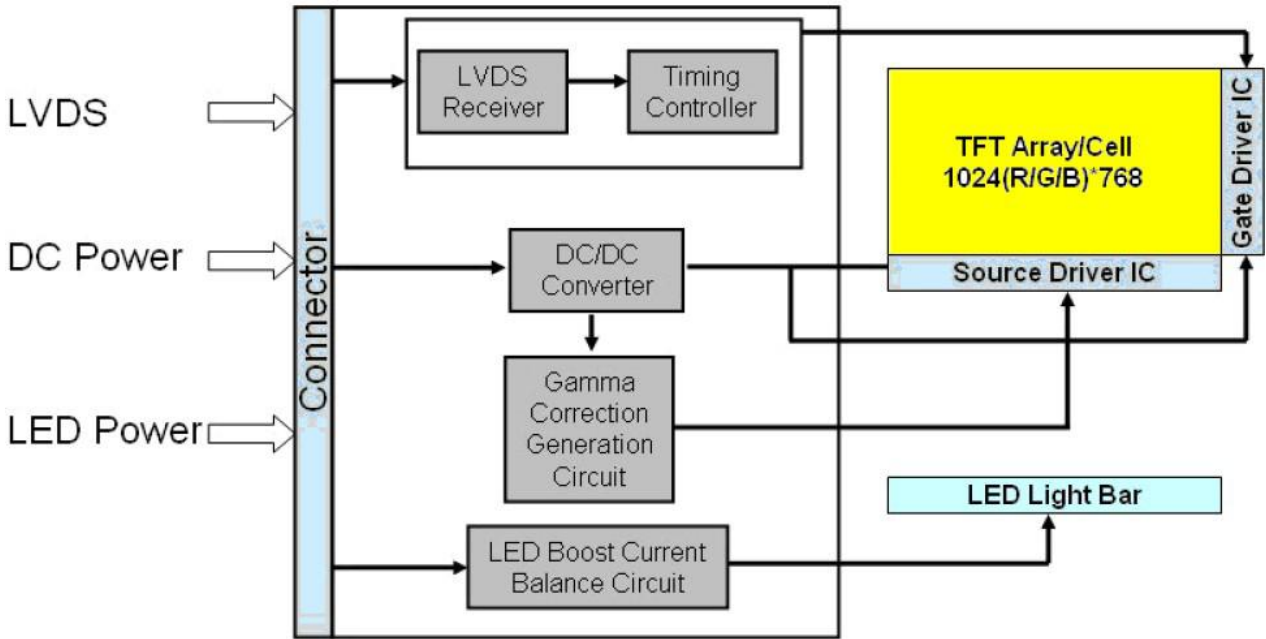
1.3 Product Summary

| Item | Specification | Unit |
|--|---|------|
| Screen Diagonal | 9.7 | Inch |
| Active area | 196.608 x 147.456 | mm |
| Pixels (HxV) | 1024 x 768 | - |
| Pixel Pitch | 0.192 (H) x 0.192 (V) | mm |
| Pixel Arrangement | R.G.B. Vertical Stripe | - |
| Display Mode | Normally Black | - |
| Contrast Ratio | (900) (Typ.) | - |
| Response Time | (20) (Typ.) | ms |
| Input Voltage | 3.3V | V |
| Power Consumption (White Pattern, (60Hz, VDD=3.3V, B/L Power = 2.38W)) | (3.36) Max. | W |
| Interface | LVDS | |
| Outline dimension (H x V) | 205.81 (typ.)x 158.06 (typ.) x 2.9 (max.) | mm |
| Support Color | 262,144 | |
| Weight | 250 | g |
| Surface treatment | Glare, 3H | |
| LCD | IVO9.7 | |

1.4 Function Block Diagram

Figure 1 shows the functional block diagram of the LCD module

Figure 1 Block Diagram

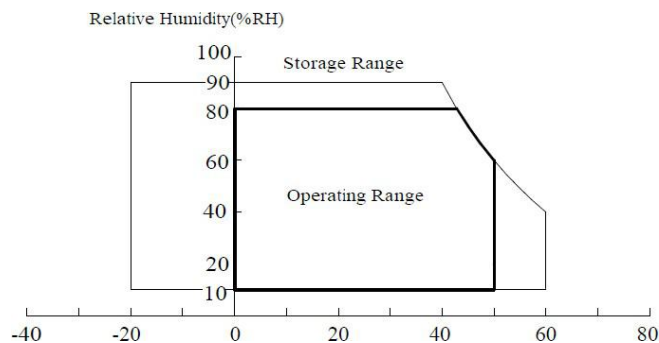


2. Absolute Maximum Ratings

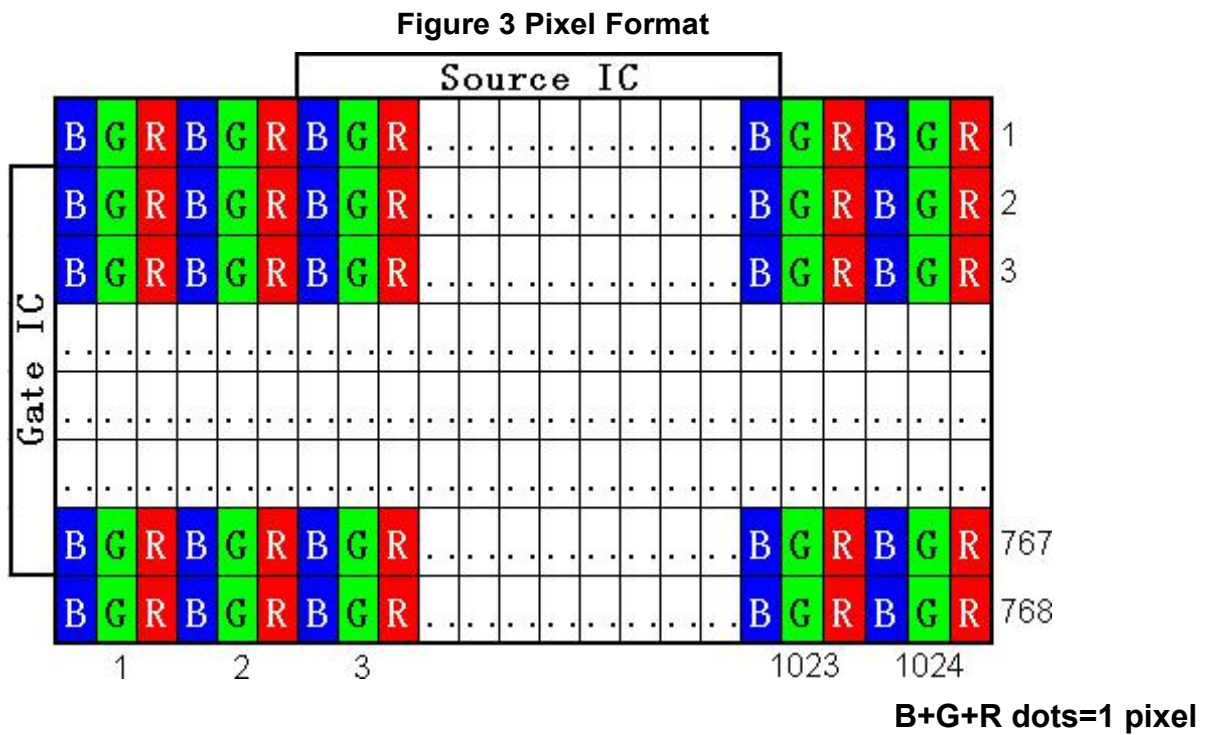
| Item | Symbol | Min. | Max. | Unit | Conditions |
|-----------------------|--------|------|------|------|------------|
| Logic Supply Voltage | VDD | 3.0 | 3.6 | V | TA=25°C |
| Operating Temperature | TOP | 0 | 50 | °C | |
| Operating Humidity | HOP | - | 90 | %RH | |
| Storage Temperature | TST | -20 | 60 | °C | |
| Storage Humidity | HST | - | 90 | %RH | |

Note: The module may be destroyed and not be recovered while the absolute maximum rating values of this product have been exceeded

Figure 2 Absolute Ratings of Environment of the LCD



3. Pixel Format Image



4. Optical Characteristics

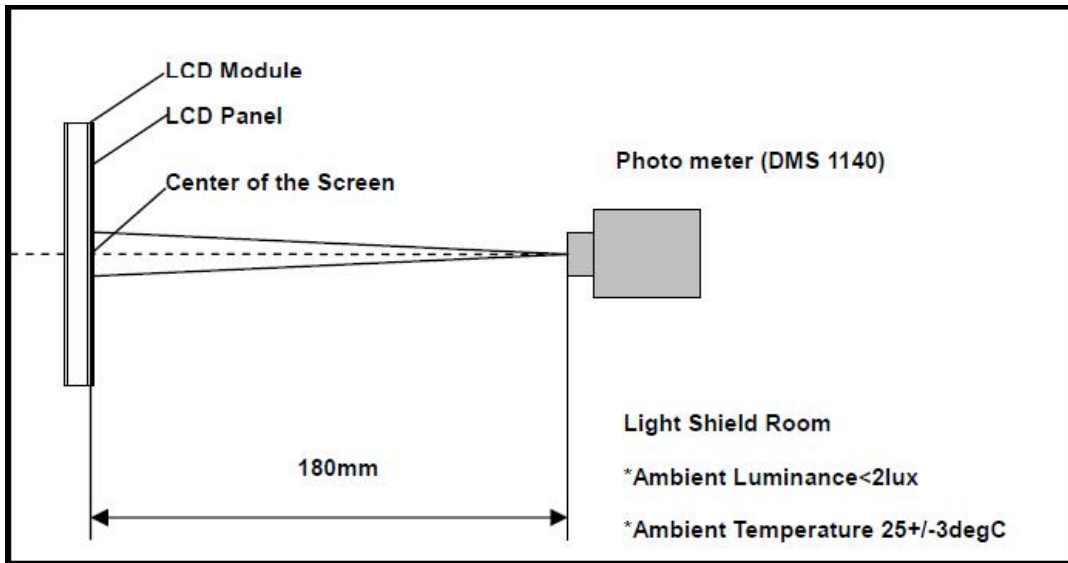
The optical characteristics are the measured under stable conditions as following notes

| Ite | Conditions | | Min. | Typ. | Max. | Unit | Note |
|---------------------------------|------------------|-----------------|-----------------|---------|-----------------|-------------------|-------------|
| Viewing Angle (CR>10) | Horizontal | θ L | TBD | 89 | - | degree | (1),(2),(3) |
| | | θ R | TBD | 89 | - | | |
| | Vertical | θ T | TBD | 89 | - | | |
| | | θ B | TBD | 89 | - | | |
| Contrast Ratio | Center | | (700) | (900) | - | - | (1),(2),(3) |
| Response Time | Rising | | - | - | - | ms | (1),(2),(4) |
| | Falling | | - | - | - | ms | |
| | Rising + Falling | | - | (20) | (25) | ms | |
| Color Chromaticity (CIE1931) | Red x | (Typ. -0.03) | (Typ. +0.03) | TBD | (Typ. +0.03) | - | (1),(2) |
| | Red y | | | TBD | | - | |
| | Green x | | | TBD | | - | |
| | Green y | | | TBD | | - | |
| | Blue x | | | TBD | | - | |
| | Blue y | | | TBD | | - | |
| | White x | | | (0.288) | | - | |
| | White y | | | (0.324) | | - | |
| NTSC | | | - | 50 | - | - | - |
| White Luminance | | | - | (350) | - | cd/m ² | (5) |
| Luminance Uniformity | 9 Point | | 80 | 85 | - | % | (6) |

Note: (1)Measurement Setup

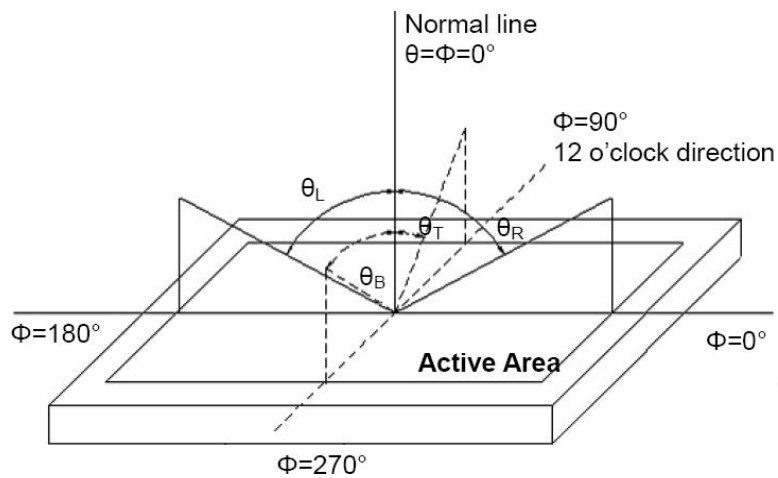
The LCD module should be stabilized at 25°C for 15 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 15 minutes in a windless room.

Figure 4 Measurement Setup



(2) Definition of Viewing Angle

Figure 5 Definition of Viewing Angle



(3) Definition of Contrast Ratio (CR)

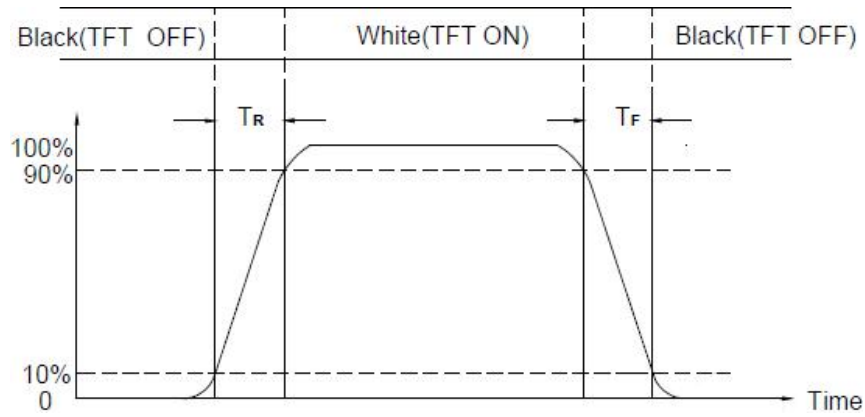
The contrast ratio can be calculated by the following expression

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

L63: Luminance of gray level 63, L0: Luminance of gray level 0

(4) Definition of Response Time (T_R , T_F)

Figure 6 Definition of Response Time

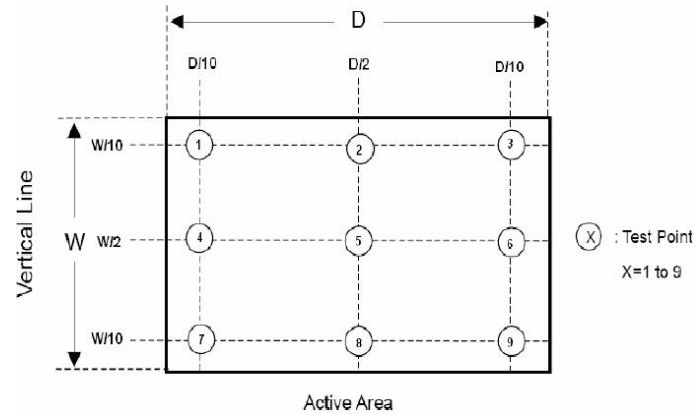


(5) Definition of Luminance White
Measure the luminance of gray level 63 at center point (Ref: Active area)

(6) Definition of Luminance Uniformity (Ref: Active area)

$$U (9 \text{ Points }) = \frac{\text{Min} (L1, L2, \dots L9)}{\text{Max} (L1, L2, \dots L9)}$$

Horizontal Line



5. Backlight Characteristics

5.1 Parameter Guideline of LED Backlight

Table 4 Parameter Guideline of LED Backlight

| Item | Symbol | Min. | Typ. | Max. | Units | Note | |
|-----------------------|---------------|--------|------|------|-------|---------|---|
| LED Input Voltage | V_{LED} | 18 | 19.8 | 21 | V | (2) | |
| LED Power Consumption | P_{LED} | - | 2.38 | 2.45 | W | (2) | |
| LED Forward Voltage | V_F | 3.0 | 3.3 | 3.4 | V | (2) | |
| LED Forward Current | I_F | - | 20 | - | mA | | |
| PWM Signal Voltage | V_{PWM_EN} | High | 2.0 | 3.3 | 3.6 | | V |
| | | Low | 0 | - | 0.5 | | |
| LED Enable Voltage | V_{LED_EN} | High | 2.0 | 3.3 | 3.6 | | V |
| | | Low | 0 | - | 0.5 | | |
| Input PWM Frequency | F_{PWM} | 200 | - | 2000 | Hz | | |
| LED Life Time | LT | 15,000 | - | - | Hours | (1) (2) | |
| Duty Ratio | PWM | 1 | - | 100 | % | (2) | |

Note (1) The LED life time define as the estimated time to 50% degradation of initial luminous.

Note(2) Operating temperature 25 °C, humidity 55%.

6. Electrical Characteristics

6.1 Interface Connector

Table 5 Connector Name / Designation

| Product Name | Part Number |
|-----------------|-------------|
| FFC/FPC 扁平电缆连接器 | F030P-05S |

Table 6 Signal Pin Assignment

| NO | Symbol | Descriptio |
|----|----------|-------------------------------|
| 1 | VSS | Ground |
| 2 | VCCS | Power Supply, 3.3V(typ) |
| 3 | VCCS | Power Supply, 3.3V(typ) |
| 4 | VEDID | EDID power, 3.3V(typ) |
| 5 | BIST | No connection |
| 6 | CLKEDID | EDID Clock Input |
| 7 | DATAEDID | EDID Data Input |
| 8 | Rxin0- | LVDS differential data input |
| 9 | Rxin0+ | LVDS differential data input |
| 10 | VSS | Ground |
| 11 | Rxin1- | LVDS differential data input |
| 12 | Rxin1+ | LVDS differential data input |
| 13 | VSS | Ground |
| 14 | Rxin2- | LVDS differential data input |
| 15 | Rxin2+ | LVDS differential data input |
| 16 | VSS | Ground |
| 17 | RxCLK- | LVDS differential clock input |
| 18 | RxCLK+ | LVDS differential clock input |
| 19 | VSS | Ground |
| 20 | NC | No connection |
| 21 | Vdc | LED Annode(Positive) |
| 22 | Vdc | LED Annode(Positive) |
| 23 | NC | No connection |
| 24 | Vdc1 | LED Cathode1(Negative) |
| 25 | Vdc2 | LED Cathode2(Negative) |
| 26 | Vdc3 | LED Cathode3(Negative) |

| | | |
|----|------|------------------------|
| 27 | Vdc4 | LED Cathode4(Negative) |
| 28 | Vdc5 | LED Cathode5(Negative) |
| 29 | Vdc6 | LED Cathode6(Negative) |
| 30 | NC | No connection |

6.2 LVDS Receiver

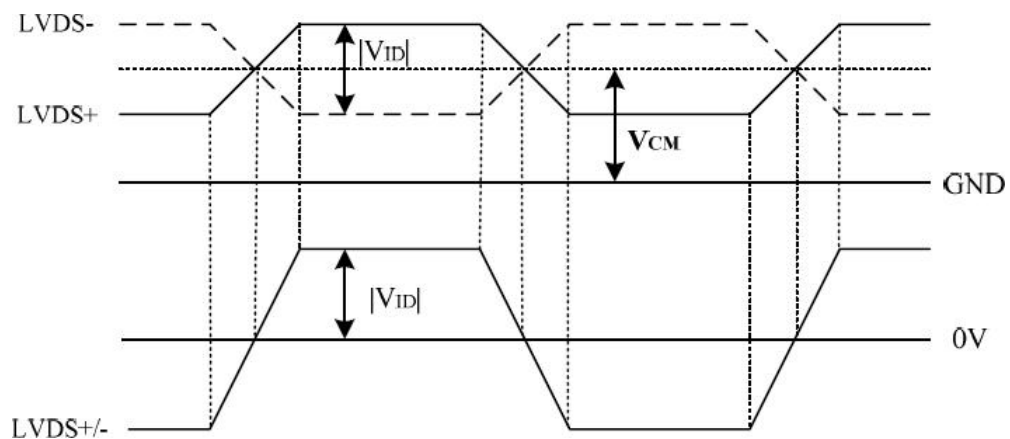
6.2.1 Signal Electrical Characteristics For LVDS Receiver

The built-in LVDS receiver is compatible with (ANSI/TIA/TIA-644) standard.

Table 7 Signal Pin Assignment

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Note |
|--|--------|-------|------|-------|------|----------|
| LVDS differential input Voltage Voltage input Threshold | VID | 200 | - | 600 | mV | |
| LVDS common input Voltage | VCM | 1.125 | 1.2 | 1.375 | V | |
| Logic High input Voltage | VIH | - | - | +0.1 | V | VCM=1.2V |
| Logic Low input Voltage | VIL | -0.1 | - | - | V | |

Figure 7 Voltage Definition



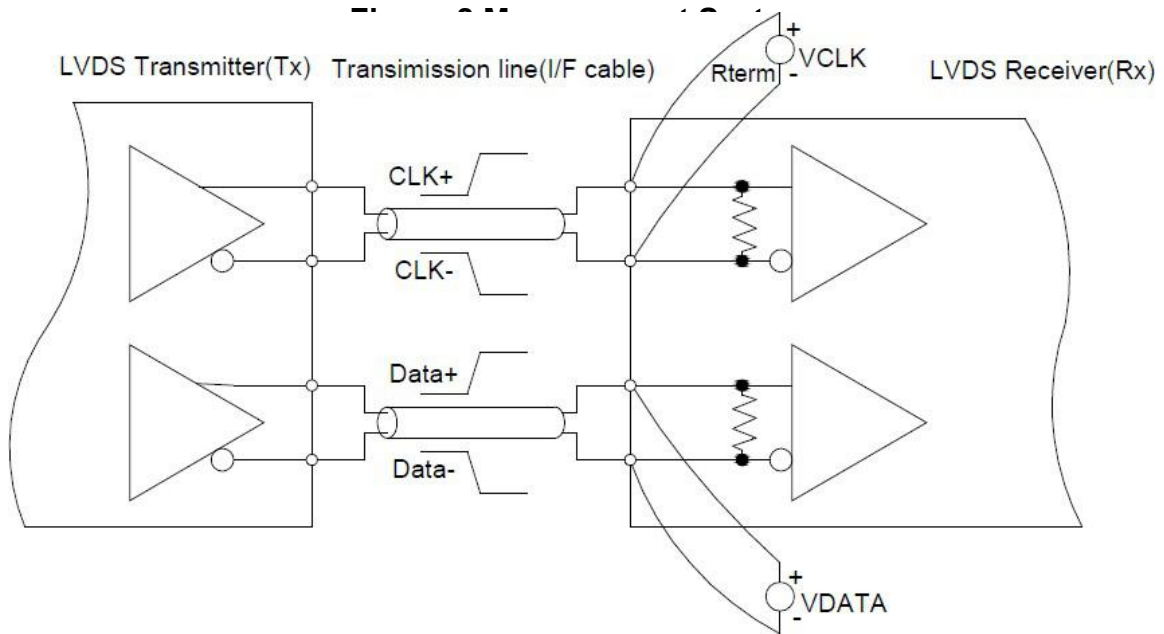
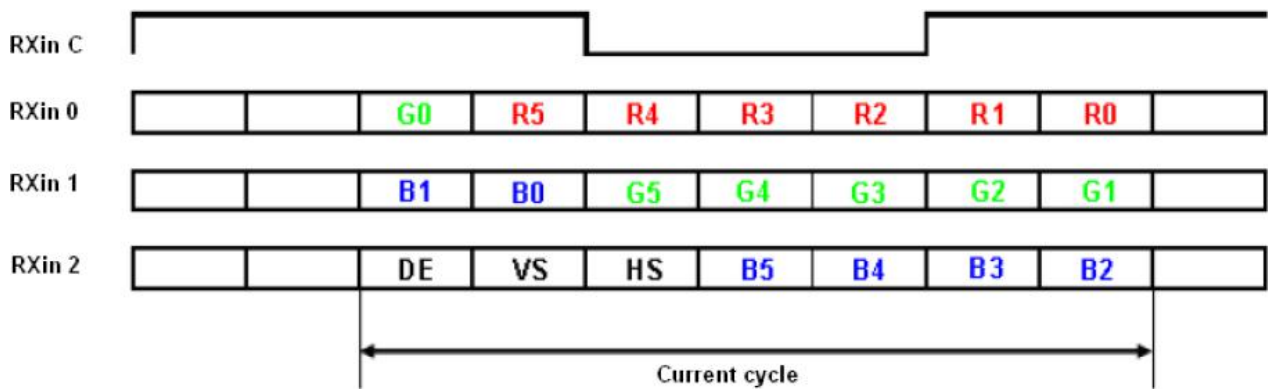


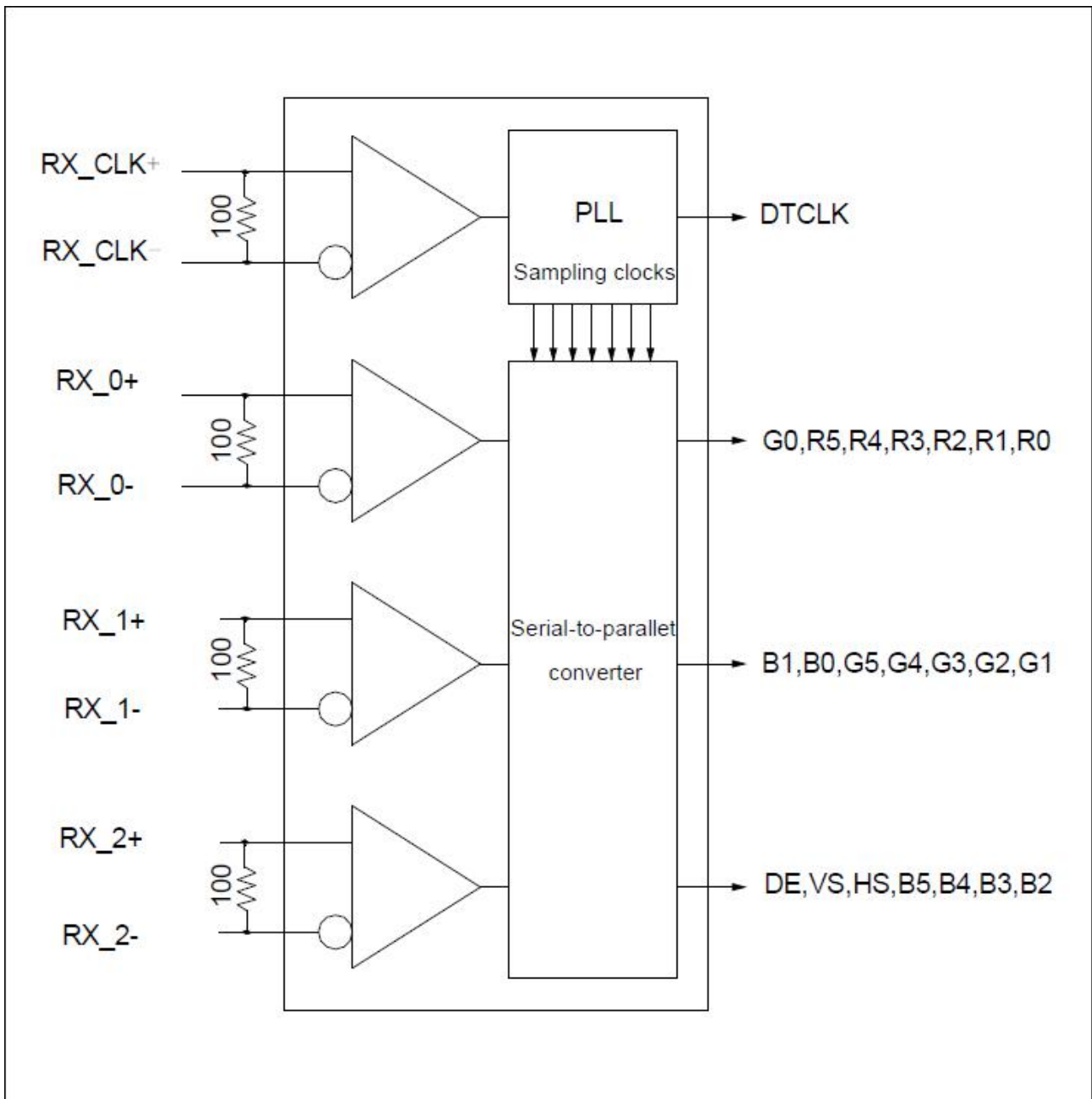
Figure 9 Data Mapping



6.2.2 LVDS Receiver Internal Circuit

Figure 10 LVDS Receiver Internal Circuit Shows the internal block diagram of the LVDS receiver. The LCD module equips termination resistors for LVDS links.

Figure 10 LVDS Receiver Internal Circuit

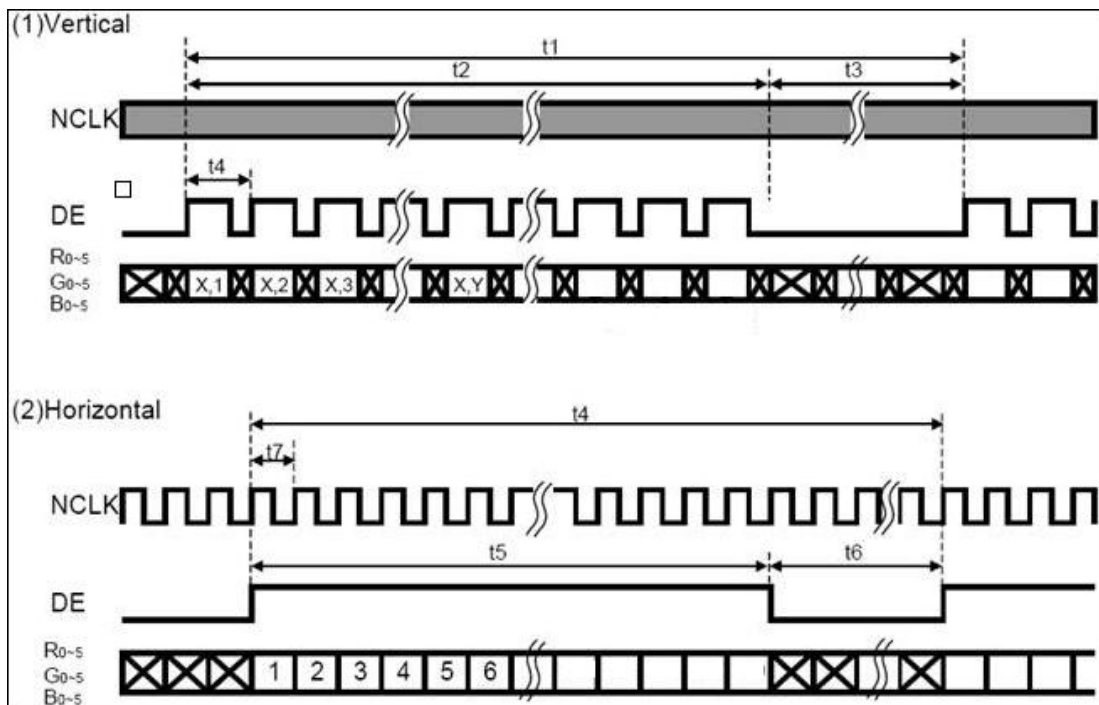


7. Interface Timings
7.1 Timing Characteristics

Table 8 Interface Timings

| Parameter | Symbol | Unit | Min. | Typ. | Max. |
|--------------------------|--------|-------|------|------|------|
| Frame Rate | -- | Hz | - | 60 | - |
| Frame Period` | t1 | line | - | 806 | - |
| Vertical Display Time | t2 | line | - | 768 | - |
| Vertical Blanking Time | t3 | line | - | 38 | - |
| 1 Line Scanning Time | t4 | clock | - | 1344 | - |
| Horizontal Display Time | t5 | clock | - | 1024 | - |
| Horizontal Blanking Time | t6 | clock | - | 320 | - |
| Clock Rate | t7 | MHz | - | 65 | - |

Figure 11 Timing Characteristics



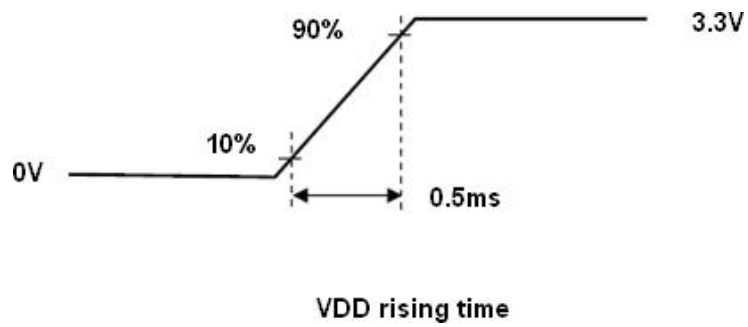
8. Power Consumption

Input power specification are as followings.

Table 9 Power Consumption

TBD

Figure 12 VDD rising time



9. Power ON/OFF Sequence

VDD power on/off sequence is as follows. Interface signals are also shown in the chart. Signals from any system shall be Hi-resistance state or low when VDD is off.

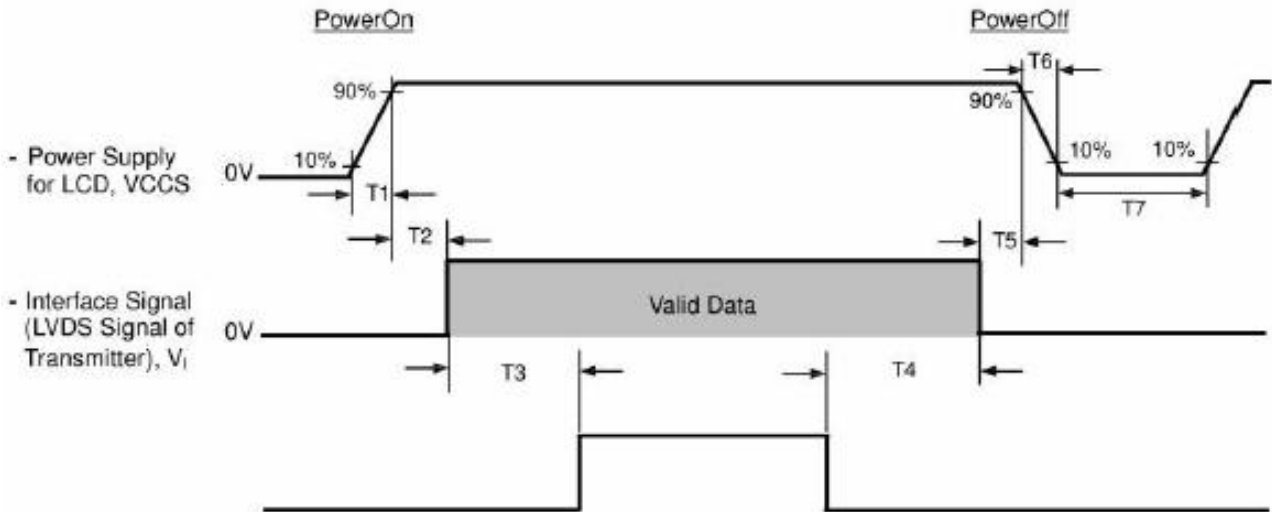


Table 10 Power Sequencing Requirements

| Item | Unit | Min | Typ. | Max |
|------|------|-----|------|-----|
| T1 | ms | 0.5 | - | 10 |
| T2 | ms | 0 | 20 | 50 |
| T3 | ms | 200 | - | - |
| T4 | ms | 200 | - | - |
| T5 | ms | 0.5 | 20 | 50 |
| T6 | ms | 1 | - | 20 |
| T7 | ms | 500 | - | - |

10. Mechanical Characteristics

| DIMENSION RANGE 尺寸范围 | | 04 | | | | | | | | | | | | | | | | | | | | | | | |
|---|------|---------------------|------------|--------------------------------|------|------|-----|-----|---|------|------|------|------|------|------|---------------------------------------|------|------|------|------|------|------|----|--|--|
| <table border="1" style="font-size: small;"> <tr> <th>TOLERANCE GRADE (±)</th> <th>0</th> <th>5</th> <th>15</th> <th>60</th> <th>150</th> <th>300</th> </tr> <tr> <td>A</td> <td>0.05</td> <td>0.10</td> <td>0.15</td> <td>0.20</td> <td>0.25</td> <td>0.30</td> </tr> <tr> <td><input checked="" type="checkbox"/> B</td> <td>0.10</td> <td>0.15</td> <td>0.20</td> <td>0.25</td> <td>0.30</td> <td>0.35</td> </tr> </table> | | TOLERANCE GRADE (±) | 0 | 5 | 15 | 60 | 150 | 300 | A | 0.05 | 0.10 | 0.15 | 0.20 | 0.25 | 0.30 | <input checked="" type="checkbox"/> B | 0.10 | 0.15 | 0.20 | 0.25 | 0.30 | 0.35 | 03 | | |
| TOLERANCE GRADE (±) | 0 | 5 | 15 | 60 | 150 | 300 | | | | | | | | | | | | | | | | | | | |
| A | 0.05 | 0.10 | 0.15 | 0.20 | 0.25 | 0.30 | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> B | 0.10 | 0.15 | 0.20 | 0.25 | 0.30 | 0.35 | | | | | | | | | | | | | | | | | | | |
| UNLESS OTHERWISE SPECIFIED 公差以上表所示，除非另有指定 | | 02 | | | | | | | | | | | | | | | | | | | | | | | |
| | | Edition 版本 | DATE 日期 | Modified description 修订内容描述 | | | | | | | | | | | | | | | | | | | | | |

(*为重点管控尺寸，()为参考尺寸)

Drawing Of B/L :
模组图:

| NO. | Parts name | Q'ty | Material |
|-----|-----------------------|------|----------|
| 1. | Housing 塑胶框 | 1 | |
| 2. | Light Guide Plate 导光板 | 1 | |
| 3. | Down_Cover 下铁框 | 1 | |
| 4. | Reflector 反射膜 | 1 | |
| 5. | Diffuser 扩散膜 | 1 | |
| 6. | Bef 增光膜 | 2 | |
| 7. | SMD-LED 发光二极管 | 36 | |
| 8. | PCB 印制电路板 | 1 | |
| 9. | LINE 导线 | 1 | |
| 10. | | | |
| 11. | | | |
| 12. | | | |
| 13. | | | |
| 14. | | | |
| 15. | | | |
| 16. | | | |
| 17. | | | |
| 18. | | | |
| 19. | | | |

| 测试点示意图 | | Backlight LED Circuit | | | | | |
|---|---------------|---|-----------------------------|-------|-------------------|------------------|----------------|
| | | <p>Backlight LED Circuit If=120mA; Vf=20.4V</p> | | | | | |
| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT | REMARK | |
| Center luminance | Lv | 350 | | | cd/m ² | 中心点 | |
| Color ranks | X | 0.280 | | 0.370 | | If=25mA/SMD | |
| | Y | 0.310 | | 0.390 | | If=25mA/SMD | |
| Forward Voltage | Vf | 18 | | 20.4 | V | If=120mA, 6※6=36 | |
| Luminance uniformity | / | 80 | 85 | | % | (Min/MAX)*100% | |
| Measuring Instrument: BM-7 (测试镜头与产品距离500±10mm); 测量视场度为1°; 温度25±3°; 环境照度不大 | | | | | | | |
| 於 單位: 测试点为9点. mm | EDITION 版本 | 01 | PART NO. 产品型号 | | APPROVED BY 核准 | CHECKED BY 审核 | DRAWN BY 编制 |
| THIRD ANGLE PROJECTION 第三角法 | SCALE 比例 | 1:1 | SHL'S P/N(exclude wrapper): | | | | |
| | DATE 日期 | 2019.07.27 | | | | | |
| | PAGE 页码 | 1/3 | | | | | |

11. Package Specification

TBD

12. Lot Mark

TBD

13. General Precaution

13.1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

13.2 Handling Precaution

- 1) Please mount LCD module by using mounting holes arranged in four corners tightly.
- 2) Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. PVO does not warrant the module, if customers disassemble or modify the module.
- 3) If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin. If liquid crystal contacts mouth or eyes, rinse out with water immediately. If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and Rinse thoroughly with water.
- 4) Disconnect power supply before handling LCD module.
- 5) Refrain from strong mechanical shock and /or any force to the module.
- 6) Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature; etc otherwise LCD module may be damaged. It's recommended employing protection circuit for power supply.
- 7) Do not touch, push or rub the polarizer with anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)
- 8) When the surface is dusty, please wipe gently with absorbent cotton or other soft Material. When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front/ rear polarizer. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- 9) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- 10) Protection film must be removed very slowly from the surface of LCD module to prevent from electrostatic occurrence.
- 11) Because LCD module uses CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge, Please be careful with electrostatic discharge. Persons who handle the module should be grounded through adequate methods.
- 12) Do not adjust the variable resistor located on the module.

13.3 Storage Precaution

- 1) Please do not leave LCD module in the environment of high humidity and high temperature for a long time.
- 2) The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.
- 3) The module should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light in storage.

13.4 Operation Precaution

- 1) Do not connect or disconnect the module in the "Power On" condition.
- 2) Power supply should always be turned on/off by 3.5 "Power on/off sequence".
- 3) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference should be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- 4) After installation of the TFT Module into an enclosure, do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.

13.5 Others

- 1) Ultra-violet ray filter is necessary for outdoor operation.
- 2) Avoid condensation of water which may result in improper operation or disconnection of electrode.
- 3) If the module keeps displaying the same pattern for a long period of time, the image may be "Sticked" to the screen.
- 4) This module has its circuitry PCB on the rear side and should be handled carefully in order not to be stressed.

13.6 Disposal

When disposing LCD module, obey the local environmental regulations.